

Radiometric Dating / Absolute time

Radiometric Dating

- only works for igneous rocks (meta sometimes)
- find out how long ago rock cooled/formed

how it works:

- radioactive elements (ex carbon 14 or uranium 238) constantly "decay" (emit alpha and beta particles or gamma rays) to form other elements (ex C14 becomes nitrogen 14, U238 becomes Lead 206) until there is no radioactive element remaining.

note: the numbers (14, 238, 206...) are the atomic mass of that element, which is the number of protons and neutrons in the atom.

ex C14 has 6 protons and 8 neutrons

- this radioactive property can be used to measure time because all radioactive elements decay at a constant (and unique) rate.

- half-life - the time it takes for half the radioactive atoms to decay into stable end product.

ex half of C14 $\xrightarrow{\text{decays}}$ N14 in 5730 yrs.

half of U238 $\xrightarrow{\text{decays}}$ Pb206 in 4.5 billion years

↑
radioactive
material
- parent

↑
stable
end product
= daughter

radioactive material
= parent

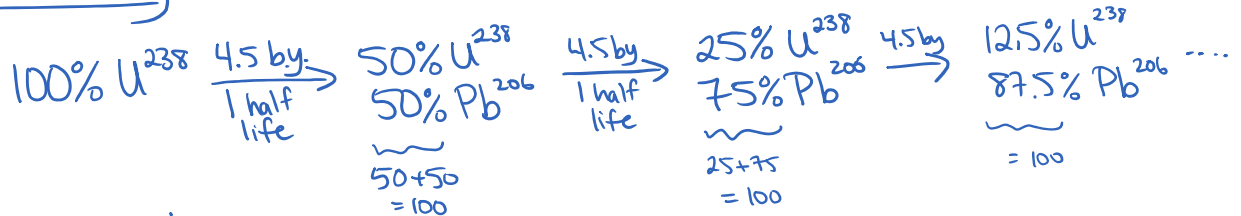
end product
= daughter

carbon dating { it takes carbon 14 (parent) 5730 years for half of it to decay to nitrogen 14 (daughter)

→ - used only for finding the age of things that were alive.

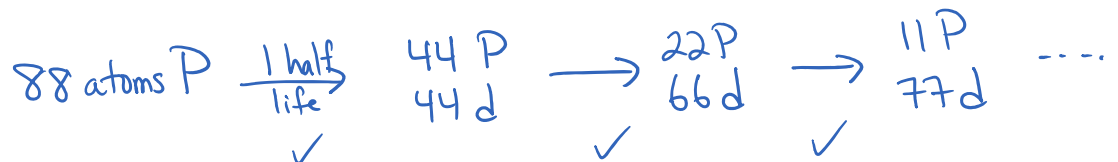
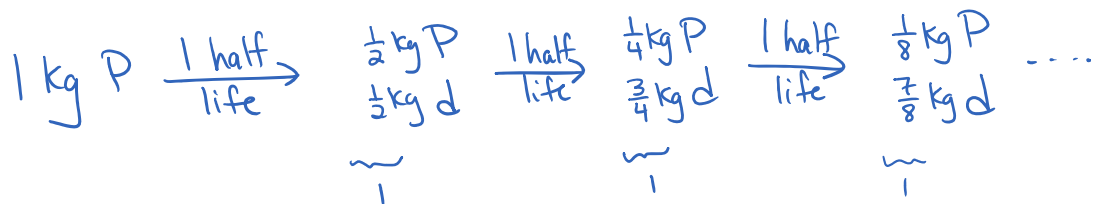
- relatively short half-life so can only use for ages up to about 100,000 yrs.

mathematically



(assumptions

- when rock formed, there was only parent (no daughter)
- it is a closed system



∴ 3 half lives have passed

$$\text{Age} = \left(\begin{matrix} \# \text{ of} \\ \text{half} \\ \text{lives} \end{matrix} \right) \left(\begin{matrix} \text{length} \\ \text{of} \\ \text{half} \\ \text{life} \end{matrix} \right)$$

Ex If 3 h.l. have passed and the parent was C14, how long has the tree been dead?

$$\begin{aligned}\text{Age} &= (3 \text{ h.l.})(5730 \text{ yrs}) \\ &= 17,190 \text{ yrs.}\end{aligned}$$

Absolute time

- radioactive dating
- count tree rings : one ring = 1 year
- count varves - annual sediment layer at the bottom of glacial lakes.

Practice Pg 5 + 6